ACHIEVING NUCLEAR, BIOLOGICAL, AND CHEMICAL DEFENSE SYNERGY THROUGH INTEGRATED LAND-, AIR-, AND SPACE-BASED SENSORS AND ANALYSIS.

A thesis presented to the Faculty of the U.S. Army Command and General Staff College in partial fulfillment of the requirements for the degree

MASTER OF MILITARY ART AND SCIENCE
Space Applications

By WILLIAM E. KING IV, MAJ, USA
B.S., University of Richmond, Richmond, Virginia, 1987
M.M.A.S., Command and General Staff College, 1998

Fort Leavenworth, Kansas
1999

Approved for public release; distribution is unlimited.

DTIC QUALITY INSPECTED 4

19990909 339

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	4 June 1999	Master's Thesis, 7 Aug 98 - 4 Jun 99

4. TITLE AND SUBTITLE
Achieving Nculear, Biological, and Chemical Defense Synergy Through Integrated Land, Air-, and Space-Based Sensors and Analysis

5. FUNDING NUMBERS

6. AUTHOR(S)
MAJ William E. King IV, US Army

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
U.S. Army Command and General Staff College
Graduate Degree Programs
1 Reynolds Avenue, Bell Hall, Room 123
Fort Leavenworth, KS 66027-1352

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING / MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE
A

13. ABSTRACT *(Maximum 200 words)*

This thesis presents a concept for a near-future application of an integrated land-, air-, and space-based system of sensors, detectors, and analysis to provide critical immediate warning, reporting, and situational updates of NBC attacks. It shows how much more efficient and effective this concept is as compared to the United States' current system of independent detectors and sensors operating separately at the various levels of command and control. Ultimately, it describes a concept that has a greater potential to achieve the United States' objective of convincing our enemies that NBC weapons will be ineffective against us. The U.S. Counter-Proliferation Initiative is the overarching strategy for countering the WMD threat. It focuses on prevention of the proliferation of weapons of mass destruction, deterrence of their use, and defense measures countering use. While these three arms of the Counter-Proliferation Initiative currently exist in separate operational bodies, they have yet to be linked in a way that will combine and, consequently, strengthen their efforts. What they lack is a system that allows all three elements of this initiative to operate simultaneously and synergistically to nullify the risk or loss of personnel and material from weapons of mass destruction usage. This thesis presents a concept to achieve this critically needed synergy. My presentation is relevant to the following topics: Weapons of Mass Destruction, NBC Defense, Sensors, Detectors, Counter Proliferation, Proliferation, Space-Based Analysis, Defense Satellite Program, Space-Based Infra Red System.

14. SUBJECT TERMS	15. NUMBER OF PAGES
Nuclear, Biological, Space-Based Sensors, Integrated Sensors	79
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNLIMITED

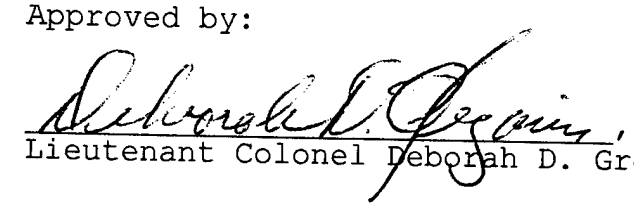
MASTER OF MILITARY ART AND SCIENCE

THESIS APPROVAL PAGE

Name of Candidate: Major William E. King IV

Thesis Title: Achieving Nuclear, Biological, and Chemical Defense Synergy Through Integrated Land-, Air-, and Space-Based Sensors and Analysis.

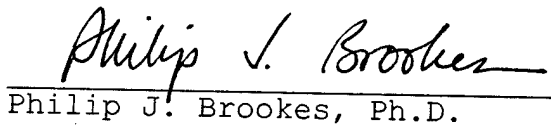
Approved by:



Lieutenant Colonel Deborah D. Gregoire, M.B.A., Thesis Committee Chairman

Major Bruce A. Leeson, Ph.D., Member, Consulting Faculty

Accepted this 4th day of June 1999 by:



Philip J. Brookes, Ph.D., Director, Graduate Degree Programs

The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

ACHIEVING NUCLEAR, BIOLOGICAL, AND CHEMICAL DEFENSE SYNERGY THOUGH INTEGRATED LAND-, AIR-, AND SPACE-BASED SENSORS AND ANALYSIS by MAJ William E. King IV, USA, 69 pages.

This thesis presents a concept for a near-future application of an integrated land-, air-, and space-based system of sensors, detectors, and analysis to provide critical immediate warning, reporting, and situational updates of NBC attacks. It shows how much more efficient and effective this concept is as compared to the United States' current system of independent detectors and sensors operating separately at the various levels of command and control. Ultimately, it describes a concept that has a greater potential to achieve the United States' objective of convincing our enemies that NBC weapons will be ineffective against us.

The U.S. Counter-Proliferation Initiative is the overarching strategy for countering the WMD threat. It focuses on prevention of the proliferation of weapons of mass destruction, deterrence of their use, and defense measures countering use. While these three arms of the Counter-Proliferation Initiative currently exist in separate operational bodies, they have yet to be linked in a way that will combine and, consequently, strengthen their efforts. What they lack is a system that allows all three elements of this initiative to operate simultaneously and synergistically to nullify the risk or loss of personnel and material from weapons of mass destruction usage. This thesis presents a concept to achieve this critically needed synergy.

My presentation is relevant to the following topics: Weapons of Mass Destruction, NBC Defense, Sensors, Detectors, Counter Proliferation, Proliferation, Space-Based Analysis, Defense Satellite Program, Space-Based Infra Red System.

ACKNOWLEDGMENTS

I am truly indebted to all of those who have contributed ideas and information in the development of this study. Many of my views and the foundation for this thesis were formulated during a space operations course that I participated in while attending the Command and General Staff College.

Thank you to Lieutenant Colonel Deborah Gregoire and Dr. Robert Kroutil for your keen insight and endless encouragement. A special thank you is due to the staff of the Combined Arms Library for their timely and invaluable assistance. You have provided the direction, resources, and focus that allowed me to produce what I hope is a meaningful and thought provoking thesis.

I am also grateful to Dr. Burton Wright, Colonels Darryl Kilgore, Richard Weiner, Michael Brown, and Thomas Klewin who have continued to provide excellent advice and mentorship. I thank you for your commitment to professional excellence and for your personal encouragement.

Finally, to my wonderful family--Elaine, my wife, for the countless hours she has spent as my personal editor on this thesis, and my children: Quentin, Morgan, Kathleen, and Kyle. Your love, patience, support, and willingness to sacrifice throughout the years, particularly during the

formulation of this thesis, has been a constant source of encouragement for me.

TABLE OF CONTENTS

ILLUSTRATIONS

LIST OF ABBREVIATIONS

ALERT	Attack and Launch Early Reporting to Theater
AO	Area of Operations
AWACS	Airborne Warning and Control System
CP	Counter-Proliferation
CPI	Counter-Proliferation Initiative
CWC	Chemical Weapons Convention
DIA	Defense Intelligence Agency
DP	Domestic Preparedness
DSP	Defense Support Program
GCCS-A	Global Command and Control System-Army
HEO	Highly Elliptical Orbit
IR	Infrared
JTAGS	Joint Tactical Ground Station
JWARN	Joint Warning and Reporting Network
LEO	Low Earth Orbit
NBC	Nuclear, Biological, and Chemical
NMS	National Military Strategy
NPT	Non Proliferation Treaty
OPTEMPO	Operational Tempo
PGM	Precision-Guided Munitions
RISTA	Reconnaissance, Intelligence, Surveillance, and Target Acquisition

RMA	Revolution in Military Affairs
SALT	Strategic Arms Limitations Treaty
SASO	Stability and Support Operations (formally Operations Other Than War)
SBIRS	Space-Based Infrared Satellite
SITREP	Situational Report
TBMD	Theater Ballistic Missile Defense
UAV	Unmanned Aerial Vehicle
WMD	Weapons of Mass Destruction (Nuclear, Biological, Chemical Warfare)

CHAPTER ONE

INTRODUCTION

> America's military superiority cannot shield us completely from this (nuclear, biological, and chemical) threat. Indeed, a paradox of the new strategic environment is that American military superiority actually increases the threat of nuclear, biological, and chemical attack against us by creating incentives for adversaries to challenge us asymmetrically.[1]
>
> William Cohen, U.S. Secretary of Defense

Despite the best-combined efforts of the world's five major powers (United States, Great Britain, France, Russia, and China), third world countries, rogue radical groups, and potential terrorist organizations continue their alarming proliferation of weapons of mass destruction (WMD) technologies. According to Secretary of State Madeleine Albright, the proliferation of WMD is "the most overriding security interest of our time."[2] Supporting her statement, in recent testimony before the Senate Intelligence Committee, the directors of the Central Intelligence Agency and the Defense Intelligence Agency agreed that the proliferation of WMD is the biggest threat to national security.

LTG Patrick M. Hughes, Director of the Defense Intelligence Agency, explained "because chemical and

biological weapons are generally easier to develop, hide, and employ than nuclear weapons," they will be "more widely proliferated and have a higher probability of being used over the next two decades."[3]

This thesis presents a concept for a near-future application of an integrated land, air, and space-based system of sensors, detectors, and analysis to provide critical immediate warning, reporting, and situational updates of Nuclear, Biological and Chemical (NBC) attacks. It shows how much more efficient and effective this concept could be compared to the United States' current system of independent detectors and sensors operating separately at the various levels of command and control. Ultimately, this thesis describes a concept that has a greater potential to achieve the United States' objective of convincing it's enemies that NBC weapons will be ineffective. This thesis underlying assumption is when the United States and its coalition partners develop the capability to deny or limit the effects of an enemy NBC attack and can promise a devastatingly disproportional retaliation, then enemy WMD will become ineffective and the threat of their use will proportionately decline.

Past World Response to WMD Threat

The five major world powers created and spearheaded international agreements with the intent of controlling the spread of WMD and the material, equipment, and technologies used in making them. Although the Nuclear Nonproliferation Treaty, SALT treaties, Chemical Weapons Convention, and the Biological and Toxin Weapons Convention encapsulate the best intentions of their creators, enforcing them has proven difficult, if not impossible. The Senate Governmental Affairs Committee concedes export control agreements "can only slow the spread of WMD technology."[4]

Nations and private companies have violated the treaties with the full knowledge that they cannot be enforced. Exporters, motivated by extremely high profits with very little associated risk, endeavor to evade economic sanctions. However, covert smuggling is often not even necessary. That is especially true of the materials, equipment, and technologies that are widely available commercially. Many of the technologies associated with the development of NBC weapons, especially chemical and biological agents, are classified as dual-use compounds because they also have legitimate civil applications. These technologies, relatively easy to obtain and convert into

weapons, are very attractive to terrorist groups who want the power of WMD without the expense. According to Ashton Carter, former Assistant Secretary of Defense for International Security Policy, "export controls alone cannot prevent proliferation," because determined leaders like Saddam Hussein can "home grow their weapons of mass destruction or get them from other countries."[5]

Current and Future Threat

As the proliferation and availability of WMD continue to expand, so do the threats and the expectation of their use. Aggressive third world countries and rogue radical groups cannot compete directly with the superpowers. The resources required for supporting a large military force, or even conducting research and development for innovative weapons systems, are beyond their capabilities. Thus, as they compete for strategic positioning, power, and international recognition, they use the most destructive devices already within their grasp. Even the weakest terrorist group believes large numbers of casualties and the ensuing panic inflicted by their insidious assaults will only promote their political objectives.

Not to be overlooked is a more subtle, indirect threat: the possibility that some seemingly inoffensive

third world state would provide chemical, biological, or radiological weapons (one of the forms of nuclear weapons) to terrorists. It could covertly contribute to the struggle without fear of direct retaliation from the United States. There is a strong possibility that several third world nations may be politically motivated to aid and abet the struggle against the stronger nations. The problem is still growing.

Renegade proliferation of WMD promotes regional instability with potentially global consequences and as a result, challenges the interests of the United States. In response, the U.S. Counter-Proliferation Initiative (CPI) focuses on prevention of the proliferation of WMD, deterrence of their use, and defense measures (active and passive) countering their use. The primary objective of this program is to prevent NBC weapons proliferation. Secondarily, if the enemy has an offensive NBC capability, the goal is then to deter its use. Thirdly, if deterrence fails and an attack ensues, the mission evolves to defend against the NBC attack with minimal casualties and degradation. While these three arms of the CPI currently exist in separate operational bodies, they have yet to be linked in a way that will combine and consequently,

strengthen their efforts. What they lack but sorely need is a system that allows all three elements of this initiative to operate simultaneously and synergistically to nullify the effects of a WMD threat.

Current U.S. Assessment

The most common examples of WMD are those containing NBC warheads. Currently, the NBC threat is equated with WMD. For the terrorist, NBC weapons provide a much cheaper, asymmetric counterbalance to U.S. precision-guided munitions, sophisticated digital awareness, and ever-evolving highly technical lethal weaponry. From a power perspective, the proliferation of WMD is classified as an asymmetric threat to the U.S., since it cannot be counterbalanced in terms of implements of war. In other words, the U.S. has renounced its offensive biological and chemical capability and stands in a position that refuses a direct, weapon-to-weapon counteroffensive when responding to WMD. The threat of WMD usage forces the Army to consider additional planning factors not normally required against a conventional enemy. For example, in order to limit the vulnerability of large groups of personnel, aircraft must be dispersed to different airfields, and several different ports must be used to off-load personnel and equipment. The

conventional "massing of forces" provides a disastrously easy target for WMD.

While the U.S. Army recognizes that a potential enemy might employ NBC weapons at anytime,[6] planning remains focused on the obvious military threat. The Army usually plans for an NBC attack during a desperate moment in the height of battle, but NBC weapons would actually be most effective during entry or deployment operations.[7] These early, preparatory stages of a tactical operation are the most vulnerable. An enemy's goal would be to quickly inflict a large number of U.S. casualties and either slow U.S. military forces deployment or swing public opinion against further involvement.

Future U.S. Response to WMD Threat

The security of the U.S. Army's future requires a system that integrates a full array of land, air, and space-based sensors that can detect and identify biological and chemical agents. These sensors must be able to detect production, storage, movement, and environmental releases. This automated, real-time, joint hazard collection system must also be capable of maintaining situational awareness, analyzing input data from the various sensors, leveraging digitized satellite communications, providing immediate

warning and reporting to those affected military and civilian populations, and updating the situational awareness database for all other forces and population centers. This system must operate from both land-based sites as well as space-based platforms--a necessary redundancy if it is to provide sufficient coverage to operate the triad of prevention, deterrence, and defense.

This concept is not unique. It is already being developed as an integrated array of sensors transmitting to a central point of analysis, warning, and reporting as the currently developing Theater Ballistic Missile Defense (TBMD) concept. The TBMD concept is built upon three pillars: attack operations, active defense, and passive defense. The attack operations pillar is focused on the U.S. Armed Force's ability to prevent the launch of theater missiles by attacking all elements of the enemy's overall ballistic missile system. The active defense pillar is focused on the U.S. Armed Force's ability to intercept and destroy theater missiles in flight. The third pillar, passive defense, includes all those individual and collective measures taken to reduce the probability and effects of theater missile attack by reducing the vulnerability of critical forces and infrastructure and by

improving the potential to survive and resume operations after an attack.[8]

The intent of this thesis is to propose a comparable system for a global WMD defense. Obviously, the U.S. Army has already erected similar pillars for NBC attack operations, as well as active defense. The third pillar WMD passive defense is also beginning to rise above its original cornerstone of individual soldier protection. This thesis will contain an examination of the networking of these three pillars and propose a way to more closely integrate and therefore unify and strengthen these pillars. But before they can be linked, the most essential pillar passive defense must be more thoroughly developed.

Passive defense is the essential individual and collective protection measures taken for friendly forces, population centers, and other critical assets. Not only must passive defense be conducted during all operational phases from predeployment through postconflict operations; it must also be ongoing during peacetime. It is the critical foundation that alerts standby assets to implement the attack and active defense pillars.

Currently, attack warnings are both general (missile launch is imminent or has occurred) and specific (specific

units or areas of the battlefield or theater are in danger of attack by a missile system). Early warning is limited to a certain geographical area or to specific units. The logistical burdens (unnecessary use of protective equipment) and both physiological and psychological effects (heat stress and physical degradation) are significant.[9] Lacking immediate warning capability, large numbers of forces often have to go into full protection as a precautionary measure. All units threatened by the hazard are warned to take immediate protective measures. This stresses soldiers.

As mentioned earlier, the foundation for passive defense should be the integration of land, air, and space sensors to provide an immediate, near real-time warning and reporting response. These sensors must be networked, real-time, all-source, detector and sensor arrays. Integration of these elements will allow the detectors and sensors to achieve agreement and counterbalance weaknesses or technical limitations in any single detector or sensor. It will also filter out or at least greatly minimize false alarms, while maximizing responsiveness to residual and downwind warning of NBC effects. This could realize incredible effects on soldier and unit morale.

Detection through the use of an array of sensors and detectors is just one part of passive defense. Another critical part is the immediate warning and reporting to affected joint forces and population centers. Currently, an integrated space-based NBC analysis system does not exist. The existing ground-based analysis systems that may give the U.S. Army limited NBC analysis are the Joint Tactical Air Ground Station (JTAGS) and Attack and Launch Early Reporting to Theater (ALERT). However, as a result of recent ongoing Force XXI initiatives, there have been advances in the development and testing of a ground-based NBC Battle Management System. This new system, currently called Joint Warning and Reporting (JWARN), is integrating digitized terrain data, meteorological and micrometeorological data, and information from intelligence systems. With data produced by unit detectors and sensors it can determine where the hazard is, where it has been, and where it is going. This integrated array of sensors and analysis may one day be transposed onto an array of satellites in a constellation to provide global coverage as well as an in-theater redundant ground capability.

The technology exists to identify launched ballistic missiles, to predict impact points, and to warn units

within affected areas. If NBC applications are integrated into this nexus, this becomes the foundation for the U.S. Armed Force's WMD passive defense. Future operations battle command will leverage this and other new technologies integrated with NBC monitoring to achieve a near real-time, common, relevant picture of the battlefield with NBC hazards and missile attack warnings scaled to levels of interest and tailored to special needs. This common relevant picture will greatly enhance force dominance through situational awareness and rapid, clear, nonhierarchical communication of hazards and warnings. Operational Tempo (OPTEMPO) will thus be greatly improved with situational awareness, selective response, and standardized unit reactions to maximize available time to react before exposure to a WMD hazard.

Along with counter-proliferation actions and coupled with the overall increase in OPTEMPO capabilities, future actual and potential proliferants will be deterred from using NBC weapons due to their "lack of value" or nullification. The U.S. and its allies will deny or limit NBC weapons political and military use by their NBC defense readiness.

Research Questions

The primary question that this thesis answers is, Can integrating a three-tier (terrestrial, air, and space-based sensors) system negate use and effects of weapons of mass destruction (NBC)?

Supporting questions are: Can the Army integrate terrestrial, air, and space-based sensors and detectors into a single system? Can the Army conduct more efficient and more rapid analysis with an integrated system? Will rapid warning and reporting resulting from an integrated sensor system increase the nullification of WMD usage effects?

Underlying Assumption

The thesis underlying assumption is when the United States and its coalition partners develop the capability to deny or limit the effects of an enemy NBC attack and can promise a devastatingly disproportional retaliation, then enemy WMD will become ineffective and the threat of their use will proportionately decline.

Significance of the Study

A publication that directly and explicitly describes this concept of integrated sensors has not been found. As a result, this thesis will be the basis for future discussion

and work to validate or further develop in integration and design of current and future sensors and detectors in order to build a layered NBC defense system as a vital future asset.

Scope and Limitations

Additionally, classified information to further illustrate points was not used in order to keep this thesis in an unclassified medium and thus distribute it more freely to cause discussion in regard to the recommendations.

Thesis Structure

To answer the thesis questions, the research addresses such key issues as: past NBC warfare by beligerant nations, the current and near term NBC threat to the U. S., the current status of sensors and detectors to defeat this threat, and the feasibility of converting current systems and making design corrections for future sensor systems. Chapter one provides the background for the thesis question, establishes the significance of the study, and provides key terminology.

Chapter two presents a historical description of two case studies where both nation states and nonstate actors use chemical weapons to attack an unprepared enemy to

achieve a quick and decisive victory. A case study is used to look at how Iraq employed chemical weapons in the Iraq-Iran War. Also the Japanese Subway attack by the terrorist group Aum Shinrikyo was used to demonstrate how a nonstate actor can gain international recognition.

Chapter three presents a review of the current status of the global NBC threat and response. It also compares the current system of independent sensors and detectors to a proposed system of integrated defense and analysis.

Chapter four contains the conclusions and presents the recommendations for future sensor and detector design and application.

---

[1]U.S. Army Chemical School, TRADOC Pam 525-20, U.S. Army Operations Concept for Nuclear, Biological, and Chemical (NBC) Defense (Draft) (Washington, DC: Department of the Army, 31 March 1998), 1.

[2]Senate Committee on Governmental Affairs, Proliferation Primer: A Majority Report of the Subcommittee on International Security, Proliferation, and Federal Services (Washington, D.C.: Government Printing Office, January 1998), 70.

[3]Quoted by Walter Pincus, "CIA Chief Calls Spread of Weapons Technology Top Threat to National Security," Washington Post, 29 January, 1998, A7.

[4]Senate Committee on Governmental Affairs, 69.

[5]Senate Committee on Governmental Affairs, Summary and 69.

[6]Richard A. Jackson and Ralph G. Wooten, "Protecting the Force: 21st Century Chemical Corps," Military Review, September-October 1996, 75. Now, more than 20 nations are known to possesses WMD. WMD proliferation is occurring exactly where the U.S. does not want it to occur--in regional flash points throughout the world.

[7]Booz Allen and Hamilton, Assessment of the Impact of Chemical and Biological Weapons on Joint Operations in 2010 (The CB 2010 Study) (McLean, VA: Booz Allen and Hamiltion, Inc., November 1997) 1-3.

[8]U.S. Army Chemical School, Theater Missile Defense (TMD) Passive Defense Strategy (Washington, DC: Department of the Army, May 1997), 2-5.

[9]U.S. Army Chemical School, Summary Evaluation Report for Combined Arms in a Nuclear/Chemical Environment Force Development Test and Experimentation--Close Combat Light, (Washington, DC: Department of the Army, May 1993), 2-4.

CHAPTER TWO

HISTORICAL BACKGROUND

The role WMD play in international conflicts are changing. They no longer represent the technological frontier of warfare. Increasingly, they will be weapons of the weak states or groups that militarily are at best second class. The importance of the different types among them also has shifted.

The amount of technical information in reference to the development of chemical and biological weapons is staggering and very inexpensive. The Journal of American Medical Association devoted an entire issue to chemical and biological warfare, and the internet is replete with home pages on the subject. The NBC Medical Defense Information Server Library is an excellent example of these home pages. Jane's Defense also has published a 470-page book US Chemical-Biological Defense Guidebook: The Most Comprehensive Resource for Chemical and Biological Agent Weaponization and Emergency Response. The US Army Chemical Corps considers this volume as an excellent single source of information for chemical and biological weapons usage.

Until the past decade, the issue was nuclear arms, period. Chemical weapons received some attention from

specialists but never made the priority lists of presidents and cabinets. Biological weapons were almost forgotten after they were banned by the 1972 Biological Weapons Convention. Chemical and biological arms have received more attention in the 1990s due to their Desert Storm threat. However, the issues posed by the trio lumped under the umbrella of mass destruction differ. Most significantly, biological weapons have received less attention than the others but probably represent the greatest danger.[1]

According to Richard Betts, a noted historian of chemical warfare, "biological and chemical warfare has been an effective combat weapon for centuries."[2] To illustrate, he describes the Tarters catapulting plague-infested bodies over the walls of the besieged city of Kaffa in A.D. 1346, perhaps starting the bubonic plague that killed 25 million people between 1347 and 1351. Chemical weapons, on the other hand, accounted for well over 1 million military and civilian casualties in World War 1.[3]

Fortunately, from a humanitarian perspective, today, chemical weapons are more widely available ergo more often used than biological weapons. Biological weapons, however, still possess the most serious threat and would be the most difficult to contain. However, since their known employment

is so small and such incidents are classified, this theis will discuss only chemical weapons usage from this point forward. Please note that in terms of application and response, the two are very similar, and passive defense measures are almost identical.

Chemical weapons have been noticed more in the past decade, especially since Iraq used them against Iranian troops in the 1980 to 1988 Iran-Iraq War and against Kurdish civilians in 1988. Chemical weapons are far more widely available than nuclear weapons because the technology required to produce them is far simpler and because large numbers of countries have undertaken chemical weapons programs.

As a result, much attention and effort has been lavished on a campaign to eradicate chemical weapons. This may be a good thing, but the side effects are not entirely benign. For one, banning chemical weapons means that for deterrence, nuclear weapons become even more important than they used to be. That is because a treaty cannot assuredly prevent hostile nations from deploying chemical weapons, while the United States has foresworn the option to retaliate in kind.

In the past, the U. S. had a no first use policy for chemical weapons but reserved the right to strike back with them if an enemy used them first. The 1993 Chemical Weapons Convention, which became effective in April 1997, requires the United States to destroy its stockpile of chemical weapons, thus ending this option. The United States did the same with biological weapons long ago, during the Nixon administration. Eliminating its own chemical and biological weapons practically precludes a no first-use policy for nuclear weapons, since they become the only WMD available for retaliation.

Until recently, the U.S. ability to deter a potential adversary from using chemical weapons relied on its capability to retaliate in kind. Today, the U.S. no longer has that capability. But the fact remains, the U.S. NBC defense capability must be sufficient to reduce the incentive for its enemies to use WMD. Would the U. S. follow through and use nuclear weapons against a country or group that had killed several thousand Americans with deadly chemical or biological weapons? It is hard to imagine breaking the post-Nagasaki taboo in that situation, but schemes for conventional military retaliation would not suffice without detracting from the force of American

deterrent threats. There is a significant risk for the United States in setting a precedent that someone could use WMD against Americans without suffering similar destruction in return.[4] Limiting the range of deterrent alternatives available to the U.S. strategy will not necessarily cause deterrence to fail, but it will certainly not strengthen it. In short, the U.S. strategy has shifted from retaliation to prevention.

The risk of employment on a reduced scale will grow as rogue nations seek to take advantage of the battlefield asymmetry that one-sided use of chemical or biological warfare can create. Since the United States no longer allows itself to use chemical or biological weapons in retaliation, NBC defense takes on a greater importance. Further, the growing biological threat and the spread of nuclear weaponry increase the importance of both passive and active defense against these weapons as well. U. S. forces must do more than survive an NBC attack--they must be trained and equipped to continue the mission under NBC conditions. Maintaining a robust NBC defense capability is the only way to ensure that the Army is ready to face an opponent who possesses an offensive NBC capability. NBC defense on a power projection battlefield is necessary to

deter and if necessary, counter an enemy's use of weapons of mass destruction.

American forces continue to be unrivaled with their state-of-the-art weapons, surveillance and information systems, and the organizational and doctrinal flexibility for managing the integration of these complex innovations into a system of systems. This integration is the key to U.S. modern military effectiveness. More than ever in military history, brains are brawn. Even if hostile countries somehow catch up in the arms race, their military organizations and cultures are unlikely to catch up in the competence race for management, technology assimilation, and combat command skills.[5]

Today, military planners focus only on the military implications of weapons of mass destruction: the asymmetric threat and vulnerability of U.S. ground, air, and naval forces abroad. This concern is all well and good, but it distracts attention away from the main danger. The primary risk is not that enemies might lob some biological or chemical weapons at U.S. armored battalions or ships. Rather, it is that they might attempt to punish the United States by triggering catastrophes using these same weapons in American cities or in ports of debarkation and

embarkation in the early stages of deployment or after critical assets have been deployed and are no longer readily available to protect U.S. citizens.

Dealing with these threats, which are both asymmetric and transnational, has implications for counter-proliferation policy and strategy, combating terrorism, force protection, and law enforcement. It will involve NBC defense, disaster and hazardous material incident response, and incident command. It will require domestic support and foreign humanitarian assistance operations. Such operations will be joint, multinational, interagency, and interdisciplinary. They will involve military medicine, mortuary affairs, patient management, and search and rescue, to name a few. The real-time common relevant picture and information sharing among these and other agencies is crucial for any hope of success.

One thing is certain, these weapons will continue to pose a threat to U. S. forces facing future contingency requirements regardless of the region or level of conflict. Nations will seek to obtain these weapons as low-cost alternatives to expensive conventional weapons that provide an added measure of political leverage in dealing with their neighbors. Some nations will seek these weapons as

status symbols to gain acceptance as world or regional powers. Whatever the reason, nations seeking or already having NBC weapons believe in their utility as force multipliers.[6]

One of the lessons of the Iran-Iraq War shows that the effectiveness of chemical weapons increases when employed against a force that is not readily capable of defending itself. Indeed, history has clearly demonstrated that chemical weapons are far more likely to be used against an unprepared force. Unless an NBC attack achieves heavy casualties and severe material destruction, it is not considered a WMD. There are two most influential factors that determine whether NBC weapons usage will achieve WMD effects. They are the "reaction time available to the people being attacked" and "methods of dissemination to those who may be exposed to a chemical attack." Two recent cases illustrate the vital role these two factors have on achieving WMD effects. The first case study is a military example of chemical weapons use during the Iran-Iraq War. The second case study is a civilian terrorist example of chemical weapons use in the subways of Japan. The reader is asked to keep in mind the conspicuous absence of early

detection, identification, analysis, and warning-reporting in these actual events.

Iran-Iraq War

What historians now consider as the decisive operation and turning point of the Iran-Iraq War erupted on the morning of 17 April 1988 when Iraq initiated Operation Blessed Ramadan to retake the Al Faw Peninsula. Armored forces of the Republican Guard spearheaded the main attack, while the Iraqi 7th Corps conducted a supporting attack along the west bank of the Shatt-al-Arab channel. Meanwhile, two amphibious assaults began along the western coasts of the peninsula. The Iraqi plan, a three-phased operation scheduled to progress over four to five days, relied heavily on the employment of chemical weapons. The Iraqis used both artillery and aircraft to deliver a non-persistent nerve agent to the intended Iranian front-line forces, command and control (C2) sites, and artillery positions. Enhanced by the successful application of chemical weapons, the operation only took thirty-five hours to complete. The Iranians never recovered from the initial assault and never reestablished an effective defense. Their retreat across the Shatt-al-Arab turned into a complete rout, with the Iranians abandoning most of their equipment.

The Iraqis did not win this battle solely by employing chemical weapons, but the impact was significant. Chemical weapons caused casualties, disrupted operations, hindered battle command and control, and allowed the Iraqis to retain the initiative throughout the attack.[7]

Lessons from the Iran-Iraq War show that the employment of chemical weapons did have tactical significance during several battles. One prophetic analyst felt the employment of "low-level, sporadic use of chemical weapons was far less devastating to those involved than it might have been or could be in future conflicts."[8] Small-scaled, perhaps, limited usage was a major contributor to Iraq's successes against an otherwise superior force. The Iraqi use of chemical weapons during its war with Iran clearly demonstrated the impact that WMD can have on the battlefield.

The major factor leading to the Iranian failure to counter the Iraqi chemical attack was lack of proper warning and reporting across the front and no warning at the points of attack. Iraqi forces were able to mass their attack at key points across the Iranian defensive positions. As they pressed onward, they found Iranian soldiers dead and stiff reaching for their masks; those who

had not been attacked with chemical weapons were overtaken in complete protective posture fearing they were still exposed in an area that contained residual chemicals and unable to fire their weapons. As panic spread, Iranian soldiers abandoned their positions and ran to the rear. So scared and unsure of their environment, they were unable to successfully defend themselves, even though they had superior weapons systems.

Japanese Subway Attack

The second example recounts a terroristic attack designed to inflict mass casualties and hysteria on an unsuspecting civilian population. The Japanese cult Aum Shinrikyo planned an attack of a very primitive but easily produced nerve gas on millions of unsuspecting civilians as they traveled homeward on a Tokyo subway.

The aim of Aum Shinrikyo was to sway public opinion, gain international recognition for its cause, and punish the Japanese government for its refusal to meet with the cult's leadership and to recognize its demands. Aum Shinrikyo fanatically believed war between Japan and the United States was imminent. With a Pearl Harbor mentality, they insisted their only hope was to initiate preemptive strikes against those countries they believed were enemies

of Japan. The government turned a deaf ear and underestimated the zeal of Aum Shinrikyo.[9]

Sometime before the afternoon of 20 March 1995, cult members surreptitiously prepositioned specially designed baggage containing the primitive but deadly nerve gas, Sarin. Pieces of luggage had been carefully fitted with battery-operated fans and vents to spray and disperse the gas. At a predesignated time, when the maximum number of people would be passing through the subway hub, the gas was supposed to be automatically released from several inconspicuous points. They intended to inflict thousands of casualties from the initial spray of the gas and expected to reap more casualties as rescue workers and crisis response teams continued to file into the invisible ambush. By divine providence, at the zero hour, the batteries failed to engage the fans; thus the Sarin gas was localized and dissipated before it could affect the multitudes of people in the subway system. Though it terminated as a fizzle and not the intended big bang, it was, nonetheless, a horrendous tragedy.[10]

The terrorist attack in the Tokyo subway killed 12 people and injured approximately 5,500 others. The emergency response system was completely overwhelmed at the

scene. Poor detection and lack of command and control at the incident site rendered approximately 135 of the 250 first responders as casualties. Ultimately, the assistance of the Japanese Self Defense Force was required to assist in the massive decontamination and cleanup effort.[11]

Besides demonstrating the potentially devastating effects of a civilian chemical attack, this example also demonstrates the first time a non-state sponsored terrorist group used WMD to gain international recognition. The Tokyo subway attack showed the world the vulnerability of its domestic infrastructures. Humankind was shocked by the reality of the danger of millions of peacetime casualties inflicted by chemical weapons at the hands of fanatics. Though the actual chemical attack did not achieve the desired killing effects in the subway, the cult did achieve its goal of gaining international recognition and forced Japan to deal with them. The Aum's use of a chemical weapon clearly demonstrated the impact and power that weapons of mass destruction can have when terrorists target innocent people.

---

[1]Richard K. Betts, "The New Threat of Mass Destruction," Foreign Affairs (January-February 1998): 77, no. 1, 3.

[2]Betts, 3; and LT. COL. Terry N. Mayer, USAF, "The Biological Weapon: A Poor Nation's Weapon of Mass Destruction," Battlefield of the Future, Air University Press.

[3]Betts, 3; and as described and illustrated in Army War College, "The Chemical and Biological Warfare Threat," (Student Handout, National Defense University).

[4]Betts, 4.

[5]Ibid, 2.

[6]Robert D. Orton and Robert C. Neumann, "The Impacts of Weapons of Mass Destruction on Battlefield Operations," Military Review (December 1993): 65.

[7]Anthony H. Cordesman and Abraham R. Wagner, The Lessons of Modern War-Volume II: The Iran-Iraq War (Boulder, CO: Westview Press, 1990); and Gordon M. Burrck and Charles C. Flowrence, International Handbook on Chemical Weapons Proliferation (Westport, CT: Greenwood Press, 1991), 110-120.

[8]Gorden M. Burck and Charles C. Flowerre, International Handbook on Chemical Weapons Proliferation (Westport, CT: Greenwood Press, 1991), 117.

[9]Abigal Haworth, "Cults: Aum Shinrikyo: Sarin," The Observer, 14 May 1995, _; and Author unknown, "Briefing Chemical and Biological Terrorism," Jane's Defense Weekly, 14 August 1996.

[10]Comments made by Senator Sam Nunn during the 31 October 1995 Congressional Testimony Hearing, Global Proliferation of Weapons of Mass Destruction (Washington, D.C.: Government Printing Office, 1996), 5.

[11] U.S. Army Chemical and Biological Defense Command, "Domestic Preparedness Defense Against Weapons of Mass Destruction (WMD)" (Aberdeen Proving Grounds, MD, 1998).

CHAPTER THREE

THREAT AND RESPONSE

Current Method of NBC Defense

The U. S. is not totally defenseless against NBC, but neither is it totally protected, which is the goal. The short fall is apparent when you consider that the myriad of sensors and detectors available for NBC defense are primarily on a land-based level and consequently have a limited scope. Though NBC detection capable systems exist or are being developed for the air- and space-based levels, they have not been applied to NBC detection and identification purposes. Simply put, the U.S. needs to raise its NBC sights.

Land-Based Systems

Land sensors, namely the M8/M9 paper, M256 and M8A1 Chemical Detectors and Alarms, Chemical Agent Monitors, and Multipurpose Integrated Chemical Alarm Detectors are issued to practically every group of soldiers throughout the levels of command (figure 1). Manually operated, they are only effective when individual soldiers activate them and carry them into a suspected contaminated area to take a reading. If the alarm sounds, the individual soldier has to physically transcribe that reading into a report and

transmit his findings to the next echelon by whatever communications channels he can access. Soldiers caught without these specialized detectors can fall back on the individual situation reports (SITREPs) to alert their units.

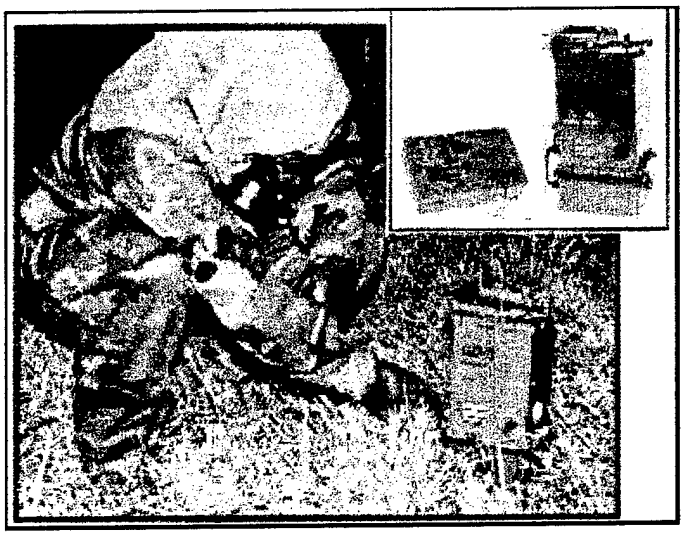


Figure 1. Individual soldier using Automatic Chemical Agent Monitor

Upon receipt of the alert at company level or above, the higher headquarters relies upon a hasty, yet time-consuming analysis by its special staff officer. The indispensable and irreplaceable function of the chemical noncommissioned officers or commissioned officer is to quickly conduct a tedious and relatively complex analysis of the NBC situation using the many details he has painstakingly collected concerning unit locations,

individual protective postures, agent capabilities, and weather factors. Once he has analyzed his data, he must make a recommendation to the commander on actions subordinate units should take to counter the actual or potential effects the agent may have on their mission, material, and personnel. When the chemical noncommissioned officer or commissioned officer completes his analysis, the unit then bears the burden of disseminating this alarming information up the chain of command—all the while, the battle continues to engage their focus. At the next higher headquarters, the cycle begins again, slowly working its way to the top.

For the sake of clarity, figure 1 dealt only with individual detection systems, but the collective or crewed systems follow the same paths of intelligence. Systems, such as the M21 Remote Sensing Chemical Agent Alarm, M93A1 NBC Fox Reconnaissance Vehicle, and the Biological Integrated Detection System (figure 2), still require near or actual contact with the release of a NBC WMD agent. They make no provision for extended standoff detection and safe surveillance of the suspected hazards.

Figure 2. M93A1 Fox NBC Recon Vehicle with M21 RASCAL mounted

These collective systems do provide a somewhat greater range and scope of NBC detection and identification. Their vulnerability, though, is comparable to that of the individual devices. They still require soldiers to risk possible exposure in order to collect an environmental sample to determine the presence of contaminates. These systems, like the individual detectors, require manual processing and transmission of that data. They are still operating with a very limited scope and surveillance capability. There is no capacity for global, regional, or large area coverage.

Air-Based Sensors

A gaping hole in the U.S. NBC detection web is right over its heads. The U.S. has no air-based detectors. No scout helicopters, surveillance planes, or AWACS to fly chemical and biological detection missions. It does not even have the equivalent of a modified weather balloon patrolling our skies. If pilots were able to spot any such attacks, they would have no "hotline" through which to alert the endangered units. For the most part, our unaffected Air Force counterparts are oblivious to the poisoned atmosphere through which ground soldiers march.

Neglected, but not abandoned, there has been some work in the development of air sensors and detectors in the past five to ten years. One promising, though still developing, air detector is the Project Safeguard Program (figure 3). It consists of an infrared spectrometer and line scanner with optical filters to provide spectral and imaging data.[1] This sensor can be mounted on a full array of aerial platforms from helicopters, fixed-wing aircraft, and unmanned aerial vehicles, to cruise missiles. The preferred platform, of course, is the Unmanned Aerial Vehicle (UAV), eliminating any risk to personnel, while still providing a

reusable vehicle (contrary to the one-time-only cruise missile).

Figure 3. Safeguard mounted in a MRUAV during CA Tests

UAVs would increase the scope of NBC surveillance and detection to an operational range of 110 to 3,500 miles at altitudes ranging from 1,000 to 65,000 feet.[2] When employed, it would be flown out to a suspected area where NBC weapons are produced, stored, or used. Then the device would take spectral and imaging readings of the surrounding air looking for trace amounts of by-product as well as the actual agent gas. It then transmits this information back to its originating source for further processing and analysis. Remember, though, this system is still only activated during suspicious circumstances, directed at

specific objects, and only provides its data back to the controller at its point of origin. This innovation reduces the risk to the individual charged with collecting hazardous agent samples, but currently, still requires a human interface and makes no cybernetic provision to share the findings with the rest of the area or theater. The capability to integrate this sensor into an automated collection and analysis constellation does exist, but, currently is not implemented.

Space-Based Sensors

Appallingly, the chemical and biological watchdogs are still earthbound. Space Age and Information Age technology has skyrocketed to unimaginable technological heights, but without the inclusion of NBC detection applications. The spectral analysis technology has been launched and orbits amidst the satellites, and though it is within our reach, we have not yet grasped its potential. With a little fine-tuning, we should be able to pick up the gaseous emanations of each and every vapor linked to chemical and biological warfare. It is simply a matter of recognizing the implications of what the U.S. can already see. The most recent example of this capability is the newest and least fully optimized Hyper Spectral Imaging.

Space sensors currently range from Defense Support Program satellites to various meteorological satellites. Though the Defense Support Program started as long ago as 1958, with the Corona program (the first space photo reconnaissance satellite), the U.S. continues to expand and have only recently begun to capitalize on the advantage space provides. One such program is the Defense Support Program (DSP) (figure 4). Implemented in 1966, DSP has provided America a missile warning satellite constellation using infrared detectors to scan the earth's surface for the hot exhaust plumes emitted by ballistic missile launches.

> The continued proliferation of ballistic missiles and weapons of mass destruction … calls for enhanced theater missile defenses and space based capabilities that will protect U.S. forces, support strategy, and facilitate warfighting.[3]
>
> General Peay, Commander, U.S. Central Command

Concurrently with the escalating WMD threat, the threat of ballistic missiles has grown enormously over the past two decades. In fact, ballistic missiles have been used in six regional conflicts since 1973. During the Gulf War, the U. S. and its coalition partners were unable to locate and eradicate Iraq's mobile launchers and, consequently, suffered several random ballistic missile

attacks. Ballistic missiles, coupled with NBC weapons, continue to pose an even greater threat to U.S. security. To effectively counter such threats, a layered defense is optimal, with the effort being made to attack prior to, during, or immediately after launch, so NBC warhead debris and contamination do not fall on friendly territory or troops. While preemptive strikes are best, our only option may be, in some situations, to engage missiles while they are in flight.

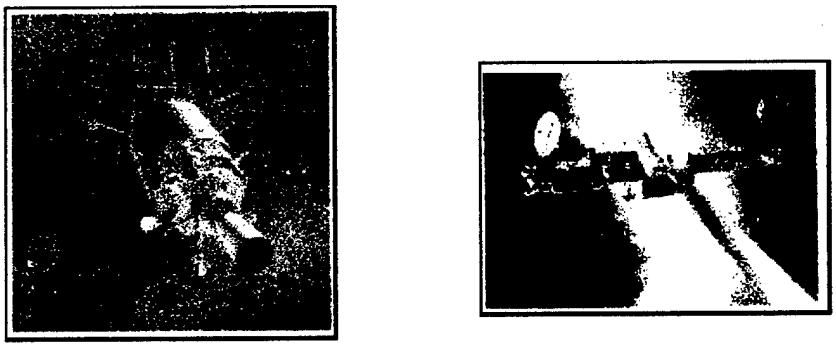


Figure 4. DSP Satellite and MILSTAR Communications Satellite

Though DSP is currently effective and able to detect current missile technology, evolving future threats require a more sophisticated enhanced capability. The Space Based Infrared System (SBIRS) architecture is our answer to that need. In the near future, Space Based Infrared System

(SBIRS) and other developing Highly Elliptical and Low Earth Orbiting (HEO/LEO) satellites will comprise the constellation of available space-based sensors. This new system, currently under development, is a "System of Systems" approach that will integrate space assets in multiple orbit configurations with a consolidated ground segment to provide more effective integration of data and better information to the warfighter. The goal is to provide a seamless transition from DSP to SBIRS and meet the jointly defined requirements of the entire defense community.[4]

The SBIRS architecture will consist of four satellites located in geostationary earth orbit (GEO), two satellites orbiting in highly elliptical orbits (HEO), and a constellation of greater than twenty satellites in low earth orbits (LEO) to provide global coverage in support of the SBIRS missions.[5] The entire SBIRS constellation will be networked together using intersatellite cross-links, thus allowing each satellite to communicate with all other satellites in the constellation. This allows for spacecraft-to-spacecraft handover of target tracks. In other words, if satellite A is tracking a missile or focused ground location and the target is leaving the field

of view of satellite A, then that satellite can cross-link to satellite B and tell it where to look for the target. Then satellite B can continue the tracking function and provide the necessary information to interceptor systems or monitor stations.[6]

Right now these satellites are only looking for the launch emissions and heat signatures of ballistic missiles. Of critical concern to the Chemical Corps is the fact that once missiles have been launched, the U.S. cannot differentiate between NBC warheads and conventional missiles. There will hardly be enough time to warn personnel within the projected impact area and less time still for them to take protective measures. This factor makes pre-launch surveillance all the more essential.

Automated Analysis Using Space and Ground Stations

An initial starting point on the space trek to meet this challenge of pre-launch surveillance has been the 1995 implementation of the Attack and Launch Early Reporting to Theater (ALERT) capability and again in 1997 with the Joint Tactical Air to Ground Station (JTAGS) (figure 5). These systems provide vastly improved capabilities to process satellite warning data and distribute it to battlefield

commanders in minimum time through efficient communication links.[7]

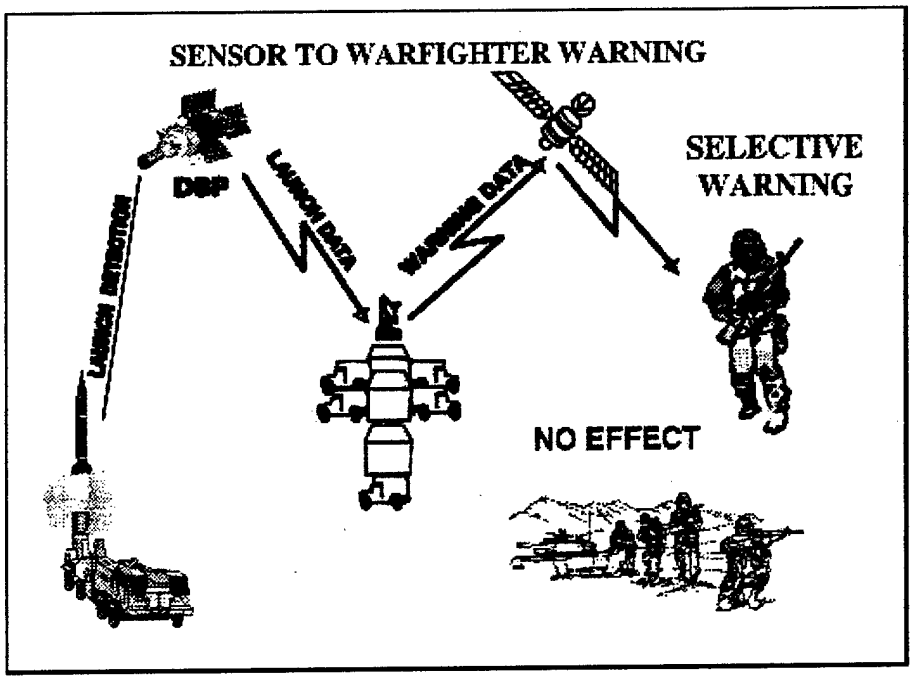


Figure 5. Current warning and reporting using JTAG and ALERT

Using existing sensors and data collection sources, global data related to theater missile warning is transmitted to the ALERT system. ALERT is a high confidence operational system that provides assured theater missile warning to warfighters worldwide. ALERT monitors all major theater war (MTW) and rest of the world (RW) areas simultaneously. Its current features include worldwide data coverage from a full DSP constellation augmented by other data sources and fusion of data at the sensor level from

multiple real time sources employing an open-system architecture using modern, commercial equipment.[8] ALERT provides improved warning of attack by short-range missiles against U.S. and allied forces overseas.

The JTAGS mission is to provide attack warnings to theater commanders within the area so that appropriate firepower can be used to eliminate the immediate threat, warn affected units of possible hazards, and to deter further enemy aggression. JTAGS is capable of receiving data directly from DSP satellites within a combat area. JTAGS is also capable of relaying processed, real time information through satellite and land communications networks to forces within a theater of operations.[9] Today, these systems and sensors, working in harmony and in concert with each other, provide the world's most sophisticated early warning system for the joint military community to support the warfighter on land, sea, and air, but only in conventional terms. The U.S. is still missing that vital NBC detection patch.

The current method outlined above, works, but only in a limited earth-bound sense, especially in light of our present day technology. The U.S. has so many more tools available to enhance our hazard detection capabilities. Not

only must the Army, but Department of Defense as well, just needs to link land-, air-, and space-based systems to achieve a far more proficient nexus.

Proposed NBC Defense Method

Land-Based Sensors

The fix is simple. The proposed method does not suggest any drastic changes, just an information link between the hand-held detector and the communication satellites. Consider the example of a domestic home burglar alarm system. If a homeowner installs an alarm in his home, a security breach will trigger the siren. Only he and his immediate neighbors will be alerted to the threat. Unless his system has a relay to the local police station, the homeowner must summon his own help or contend with the intruder alone. If the situation rages beyond his control, he is lost and his neighbors may inherit the risk. Conversely, the homeowner who is connected to a larger security surveillance complex, need not rely on his individual capabilities. Help is summoned and warnings are broadcast the instant the intruder violates his property. Networking is the key--instantaneous and automatic.

The proposed method does not suggest to change anything with the current array of land sensors and

detectors (at least in the immediate future) except to add a capacity for each of them to automatically transmit their readings. They must be modified to transmit their data to a centralized automated analysis system using our already established satellite communication systems, such as the Global Command and Control System-Army (GCCS-A). Utilizing regular communications links, we simply speed the analysis and, thus, warning-reporting procedures throughout the various levels of command. This minor change would link land-based systems into a global communications system and would overlay the information already provided by early readings from space and air sensors.

Air-Based Sensors

The fix here is not so simple. The proposed method suggests that the U.S. continue to aggressively pursue methods of embedding sensors and detectors into aerial platforms in order to increase our tactical and operational scope of surveillance and monitoring. Just as with the land-based systems, these sensors must be linked to communication satellites. Using the previous example of a domestic home burglar alarm system, the aerial sensor would extend the protection to the "yard" and provide large area surveillance and earlier warning of an impending intruder.

This earlier warning may provide enough time for intercept before the intruder enters the home. It may also provide directional focus for the ground-based detectors and better concentrate their sensitivity.

As the U. S. develops air-based sensors, it must incorporate a capacity to transmit their data instantaneously to a centralized automated analysis system (i.e., Global Command and Control System-Army (GCCS-A). This adaptation would overlay the information already provided by early readings from land sensors.

Space-Based Sensors

As with the air-based sensors, the fix is more complex. The U.S. must carefully think through the future technological requirements and integrate future force planning into surveillance and detection sensors. Satellites take years to build and, once launched, will be inaccessible for corrections or modification for many more years. Many of the programmed satellite systems have highly sophisticated chemical and biological applications already designed into them. The U.S. must now look at ways of exploiting these mechanisms and capitalizing on their inherent capabilities. Just as with the land- and air-based systems, these sensors must be linked to our communication

network. Using the previous analogy of a domestic home burglar alarm system, the sensor can now track for the homeowner every potential visitor who enters the neighborhood, identifying them as either friendly or hostile. A space sensor would provide global, regional, as well as large area, surveillance and early warning of all chemical and biological signatures within a theater of operations. This earlier warning would be critical during periods of passive defense, alerting us to incipient dangers. Peacetime operations would gain the security of early detection and an enhanced posture for preemptive strikes or intercept. Early space-based detection and identification can activate the attack operations pillar long before the offense is committed. No longer could a pharmaceutical plant provide a front for chemical or biological weapons production. The products manufactured therein would write their signature in the wind, and the U. S. would read them (erasing at its discretion).

Now linked by land, air and space, we have erected our three-tiered defense against weapons of mass destruction.

Comparison of Current to Proposed Method

Let us consider the current capability of the U. S. with respect to the two real world chemical WMD scenarios. Once the perspective of the U. S. current defense status has been over-laid onto the situation, this thesis will apply an application of the proposed method of WMD defense to illustrate its enhancements.

The U. S. current NBC readiness, for all practical purposes, is not much different than it was in 1988. The Iranians, however, had nothing comparable with which to prepare or protect themselves from an NBC attack. If, though, for the sake of comparison, you consider what might have happened if they had the U. S. current NBC posture, history may have taken a radically different course.

Although the Iranians would not have been able to monitor the transport of the chemical artillery or aircraft delivery devices before the battle had begun, they would have been able to ascertain the detonation of nerve agent munitions as they occurred. Iran would probably have still suffered some casualties from the initial attack, but its front line units could have identified the deadly gas and relayed that information to its headquarters. Other units would then have known what they were to expect. The

defending ground troops would have been able to respond appropriately. Those closest to the poison would have been warned in time to don protective gear. Those out of the reach of the toxin could have fortified their conventional defensive positions and prevented the advancement of the outnumbered Iraqi invaders. Instead of abandoning their superior weapons in a wave of panic, the Iranians could have utilized their conventional military advantage and defeated the Iraqi army. Furthermore, through continuous monitoring of the front, they would have been able to ascertain the inevitable dissipation of the nerve agent and could have safely conducted a counterattack to seize the Iraqi's strategic resources, ending the battle and possibly the war on Iranian terms.

Now, if the Iranians were able to monitor the Iraqi preparations from our integrated system of NBC sensors, starting with overhead air and satellite surveillance, they would have been able to track the movement of NBC munitions from production or storage sites. By tracking these sensitive munitions and taking protective measures along with active diplomatic messages, the Iranians would have removed the element of surprise. Offensively, the Iranians may have also taken one well-placed preemptive strike to

put an end to that impending threat. In theory, if the Iraqi plan depended so much on the use and success of chemical weapons in order to seize the initiative and overcome the advantages of the Iranian defenses, the Iraqis may not have attacked in the first place. Iranian preparation would have ultimately negated or nullified the purpose or use of chemical weapons in the Iraqi plan.

Returning to the application of our current methodology, the Japanese could have alleviated their subway catastrophe with similar defensive measures. Disregarding the speculative preventive measures, once the Aum Shinryko attack occurred, the number of casualties could certainly have been minimized. If the first responders had been trained and equipped with common U.S. NBC agent detectors (accompanied by MOPP gear), they would not have become casualties themselves. Quick, on site identification of the Sarin gas would have set in motion the procedures for evacuation and containment of the stricken area. Medical personnel would have gained precious minutes lost to diagnostic testing, if they had known in advance that their patients were suffering from Sarin gas exposure. Specific antidotes could have been more quickly

administered and the twelve lost lives may have had a better chance of survival.

Looking slightly ahead to the future, with the application of an air and satellite surveillance sensor system, it is quite probable that the cult's production facility would have been spotted. Knowing that Aum Shinryko had already used chemical weapons in past assignation plots, the Japanese government would have been able to ferret out the cult's dastardly intentions. A routine raid on the chemical factory, and there would have been no WMD to contend with in the subway.

---

[1]Robert T. Kroutil, Program SAFEGUARD: Brief Overview Summary of the Concept of Operations (Aberdeen Proving Grounds, MD: Edgewood Research, Development, and Engineering Center, 1998), 5-10.

[2]Kroutil, 6.

[3]Testimony before Congress by General William Peay, Commander, U.S. Central Command.

[4]Author unknown, SBIRS Guide, "Providing the Essential High ground Advantage of Space Based IR Surveillance to the Warfighter of the 21st Century," (Space and Missile Systems Center, Los Angeles, AFB, 1998), 10.

[5]Ibid, 10.

[6]Ibid, 21.

[7]Ibid, 12.

[8]Ibid, 15.

[9]Ibid, 16.

CHAPTER FOUR

SUMMARY AND CONCLUSION

The Army must abandon the Cold War thought that NBC weapons are a last desperate resort after a period of conventional conflict. In recent conflicts, eighty percent of internationally verified cases of chemical warfare occurred early in the conflict, even though other effective military options were still available.[1] Chemical weapons were used to seize the psychological offensive--to terrorize, intimidate, and ultimately achieve victory over the adversary.

However, if these attacks could have been anticipated by even an hour, their catastrophic outcomes could have been significantly reduced or completely avoided. But, tragically, no one anticipated these heinous attacks, and the passive defense measures were not in place--No warning, no time, no defense, no escape, no survival.

America's unrivaled military superiority means that potential enemies, whether nations, terrorist groups, or individuals, who chose to attack the U. S. will be more likely to resort to terror instead of conventional military assault. Moreover, easier access to NBC weapons technology means that the destructive power available to terrorists is

greater than ever. Adversaries are more tempted to use unconventional tools, such as WMD, to target our cities and disrupt the operations of the government.[2]

It would certainly give the U. S. more peace of mind if we could be assured that the various violent groups with grievances against the American government and society would continue to prefer conventional explosives over WMD. Few terrorist groups have shown an interest in inflicting true mass destruction. Bombings or hostage seizures have generally threatened no more than a few hundred lives. The U. S. hopes that this limitation has been due to a powerful underlying ethical or moral reason, rather than a simple lack of capability, and that the few exceptions do not become the rule.[3]

There is no guarantee that the U.S. can continue to rely on such restraint. Indeed, some groups have tried to use WMD, only to see them fail. Eventually such groups will correct their mistakes and become less incompetent. If terrorists decide that they want to stun American policy makers by inflicting enormous damage, WMD become more enticing at the same time they are becoming more accessible.

The use of these weapons could also be threatened for the purpose of blackmail and extortion. Even if the weapons are not used, the threat to use them could cause panic and terror in the United States or elsewhere. An accident involving a proliferant's weapons could have significant international repercussions and may be the most likely scenario for an actual incident.

Based on the continuing spread of WMD, no region or level of involvement is exempt from potential use of such weapons. Delivery systems range from intercontinental and ballistic missiles through standard battlefield weapons such as artillery and bombs. Terrorists or special operations forces prefer selective employment methods such as rented trucks or boats and small packages. It is reasonable to assume that the U. S. potential enemies also learned lessons from the recent operations in the Gulf War. They know U. S. current capabilities as well as we do. They have heard news broadcasters and subject matter experts analyze U. S. vulnerabilities on global television. They think they can win.

Protecting the force against WMD must be a full time operation, not just during conflict, and war. Training, logistics readiness, and intelligence are critical

components. Units must train to protect themselves and to operate under NBC conditions. Just getting the troops into MOPP gear is not enough. The protective equipment, NBC reconnaissance systems, detectors and alarms, decontamination capability and other critical items must be available and ready to use. Tactics, techniques and procedures must be understood and practiced. Understanding the enemy's threat, capabilities, and intentions is a continuous task. The U.S. cannot afford any surprises now or in the future.

During force projection operations, commanders must look at the impact of WMD by each stage of the operation. Intelligence concerning the enemy's capability to employ NBC weapons is critical. Types of weapons, delivery means, production and storage facilities, and employment doctrine are examples of the intelligence required long before deployment begins. The ability of the enemy to use WMD will affect the planning process used to determine a unit's mission, course of action, and force structure.

NBC defense training at all levels is essential for providing a force capable of projection to regional conflicts. While units may not expect to deploy to a theater where there is an NBC threat, it can occur. Army

planners must assume that an NBC capable enemy will not allow the U. S. to mass our combat power and conduct a lengthy preparation period that includes extensive NBC defense training.

The prospect of rogue states, criminals, and terrorists possessing nuclear, biological, and chemical weapons may make their use more likely, even in a world where reductions in the weapons of established nuclear and chemical states is theoretically occurring. There can be no question about the overarching U. S. objective: deterrence of WMD proliferation through the fully networked cooperation of the government and the private sector--the Department of Defense, the Department of Energy defense laboratories, and industry.[4] Existing capabilities and new integrated programs in development, especially in the areas of air and space sensor and information technologies and threat assessment, should play a leading role in the area of technical intelligence relating to proliferation.[5]

The U. S. cannot stand by idly while such a danger grows. The only way this emerging threat can be contained is by a clear and forceful U.S. policy. A policy that will lead, not only the U.S. domestic and defense agencies, but also the international community in a concerted effort to

prevent, deter, and, if necessary, respond to acquisition, threats, and prospective use of WMD.[6]

> Weapons of mass destruction, nuclear, biological, and chemical, along with their associated delivery systems, pose a major threat to our security and that of our allies and other friendly nations. Thus, a key part of our National Security Strategy is to seek to stem the proliferation of such weapons and to develop an effective capability to deal with these threats.[7]
>
> The National Security Strategy, 1998

The Department of Defense and the Army must actively monitor its adversaries and provide a vigilant watch over changing threat conditions. It must also support threat reduction programs and seek to eliminate stockpiles of NBC weapons from the world's arsenal. When asked to deploy, we must, in conjunction with joint and coalition partners, aggressively attack the adversary's ability to employ NBC weapons on the battlefield. When required, as part of a joint and combined team, we must fight and win under NBC conditions.[8]

The Army must also employ an aggressive defense system against NBC threats. This defense system must use information age technology to maintain OPTEMPO without increasing the risk to our forces. In an NBC threat environment, aggressive active and passive NBC defenses

increase joint battle space visualization and NBC threat, weather, and friendly force situational awareness. Thus, it gives the joint force commander the freedom to operate without taking cumbersome NBC protective measures. This NBC defense must use information technology as a force multiplier to concentrate resources when and where they will be actually needed on the battlefield.[9]

At the strategic level, the Army must participate as a joint and interagency team member to promote stability, thwart aggression, and raise the threshold for NBC weapons' employment. This NBC defense is successful when the U.S. is able to:

1. Deny the adversary any potential or strategic advantages if he threatens to use or uses NBC weapons.

2. Maintain our speed, agility, and decision making advantages under NBC conditions.

3. Protect the force from NBC hazards.

At the operational and tactical levels of war, the U.S. must employ an aggressive NBC defense to maintain OPTEMPO and protect the force by applying the following NBC defense tenets:

1. Maintain visualization of NBC conditions throughout the joint battle space.

2. Protect the joint and coalition force.

3. Rapidly restore combat power after attacks.

Aggressive active and passive defense measures go beyond the currently accepted contamination avoidance doctrine. Simply stated, intelligence, operations, weather, unit locations, and NBC detector information must be networked to give a common awareness of the NBC situation so that all units and elements within the battle space can implement active and passive defenses to negate WMD effects. NBC attack alerts must be quickly passed from the sensor network to all units and populations centers, using nonhierarchical warning methods. Battle space visualization and rapid warning capabilities will enable units to implement risk management procedures and operate in a vigilant but unencumbered posture. Just before or during actual attacks, these units can now rapidly transition to higher protection levels. Efforts begin immediately to restore the unit to a normal operating posture and full combat effectiveness before being exposed to the devastating effects of WMD.

This thesis presented a concept for a near-future application of an integrated land-, air-, and space-based system of sensors, detectors, and analysis to provide

critical immediate warning, reporting, and situational updates of NBC attacks. It showed how much more efficient and effective this concept could be compared to the United States' current system of independent detectors and sensors operating separately at the various levels of command and control. Ultimately, this thesis clearly demonstrated a concept that has a greater potential to achieve the United States' objective of convincing our enemies that NBC weapons will be ineffective.

---

[1]Betts, 4.

[2]Fact Sheet, "Combating Terrorism: Presidential Decision Directive 62," 22 May 1998, 1.

[3]Betts, 3.

[4]Pete V. Domenici, "Countering Weapons of Mass Destruction," The Washington Quarterly (Center for Strategic and International Studies, Winter 1995): 150.

[5]Domenici, 150.

[6]Domenici, 150.

[7]Author Unknown, A National Security Strategy for a New Century, The White House, October 1998, 11-12.

[8]Richard A. Jackson and Ralph G. Wooten, "Protecting the Force: 21st Century Chemical Corps," Military Review (September/October 1996): 76.

[9]Jackson and Wooten, 76.

BIBLIOGRAPHY

Articles

"Urban Terrorism-Chemical Warfare in Japan." Jane's Intelligence Review, (November 1995).

Barnaby, Frank. "Weapons of Mass Destruction: A Growing Threat in the 1990's."Conflict Studies 235, (October/November 1990).

Betts, Richard K. " The New Threat of Mass Destruction: What if McVeigh had used Anthrax?" Foreign Affairs, 77, no.1 (January-February 1998).

Betts, Richard K. " The New Threat of Mass Destruction." Foreign Affairs, 77, no. 1, (January-February 1998).

Domenici, Pete V. "Countering Weapons of Mass Destruction." The Washington Quarterly, (Winter 1995): 145-152.

Harkavy, Robert E. "Triangular or Indirect Deterrence/ Compellence: Something New in Deterrence Theory?" Comparative Strategy, (January-March 1998).

Haworth, Abigal, "Cults: Aum Shinrikyo: Sarin." The Observer, (14 May 1995).

Haworth, Abigal, "Briefing Chemical and Biological Terrorism." Jane's Defense Weekly, (14 August 1996).

Horner, Charles A. "Space Systems Pivotal to Modern Warfare." Defense 94, no. 4, 20-29.

Jackson, COL Richard A., and MG Ralph G. Wooten. "Protecting the Force: The Twenty First Century Chemical Corps." Military Review, 76, no. 5 (September-October 1996): 75-80.

Mayer, LT. COL. Terry N. "The Biological Weapon: A Poor Nation's Weapon of Mass Destruction." in Battlefield of the Future, Air University Press.

Mercier, Charles L., Jr. "Terrorists, WMD, and the US Army Reserve." Parameters, 27 (Autumn 1997): 99-103.

Pincus, Walter. "CIA Chief Calls Spread of Weapons Technology To Threat to National Security." Washington Post, 29 January 1998.

Schneider, Barry R. "Strategies for Coping with Enemy Weapons of Mass Destruction." Airpower Journal, Special Edition, 1996, 36-47.

"The Chemical and Biological Warfare Threat," Student Handout, National Defense University.

US SPACECOM. "Providing the Essential High Ground Advantage of Space Based IR Surveillance to the Warfighter of the 21st Century." SBIRS Guide, Space and Missile Systems Center, Los Angeles, Air Force Base. 1998.

Books

A National Security Strategy for a New Century. Washington, DC: Government Printing Office, October 1998.

Burrck, Gordon M., and Charles C. Flowrence. International Handbook on Chemical Weapons Proliferation. Westport, CT: Westview Press, 1991.

Cordesman, Anthony H., and Abraham R. Wagner. The Lessons of Modern War-Volume II: Iran-Iraq War. Boulder, CO: Westview Press, 1990.

Counterproliferation Program Review Committee Annual Report to Congress. Report on the Activities and Programs for Countering Proliferation and NBC Terrorism. Washington, DC: Government Printing Office, May 1997.

Danzig, Richard. Biological Warfare: A Nation at Risk--A Time to Act. Strategic Forum 58, Institute for National Strategic Studies, National Defense University, Washington, DC, January 1996.

Davis, Zachary S. Nonproliferation Regimes: Policies to Control The Spread of Nuclear, Chemical, and Biological Weapons and Missiles. Washington DC: Library of Congress, Congressional Research Service, 18 February 1994, CRS Report 93-237-ENR.

Grinevsky, Oleg A. Counterproliferation: Panacea or Threat? International Perspectives on Counterproliferation, Working Paper No. 99. Chapter 4, Washington: Woodrow Wilson International Center for Scholars, January 1995.

ST-22. Writing and Speaking for Senior Leaders. CGSC, 1991.

Turabian, Kate L. A Manual for Writers of Term Papers, Theses, and Dissertations. 6th ed. Chicago: University of Chicago Press, 1996.

US Department of Defense, Proliferation: Threat and Response. Washington: April 1997.

US SPACECOM, USSPACECOM Long Range Plan. Washington DC: Government Printing Office, April 1998.

Field Manuals and Pamphlets

US Army Air Defense School. FM 100-12 (Final Draft), Army Theater Missile Defense. Washington, DC: Department of the Army, 2 April 1998.

US Army Chemical School. TRADOC Pam 525-20 (Draft), US Army Operations Concept for Nuclear, Biological, and Chemical (NBC) Defense. Washington, DC: Department of the Army, 31 March 1998.

US Army TRADOC. TRADOC Pam 525-5, Force XXI Operations. Washington, DC: Department of the Army, 1 September 1997.

Theses, Monographs, and Strategy Research Projects

Carter, COL Robert D. Domestic Terrorism and Our National Security Strategy. Strategy Research Project, US Army War College, Carlisle Barracks, PA, 1 April 1998.

LeHardy, MAJ Frank A. Deterring Weapons of Mass Destruction. Naval Post Graduate School, Monterey, CA, December 1997.

Rushworth, LTC Charles T. The Theater Commander's Preemptive Strike Option Against WMD. Department of Joint Military Operations, Naval War College, Newport, RI, 16 June 1997.

Ryan, LTC Michael W. Weapons of Mass Destruction. US Army War College, Carlisle Barracks, PA, 30 April 1997.

Government Briefings and Studies

Booz, Allen and Hamilton, Assessment of the Impact of Chemical and Biological Weapons on Joint Operations in 2010 (The CB 2010 Study). U.S. Department of Defense Study, McLean, VA: Booz Allen and Hamiltion, Inc, Novemebr 1997.

Clinton, President William J. "US Policy on Counterterrorism." Presidential Decision Directive 39. Washington, DC, 21 June 1995.

Clinton, President William J. "US Policy on Critical Infrastructure Protection." Presidential Decision Directive 63. Washington, DC, May 1998.

Jason Program Office. Report to the Chairman JCS, Counter Proliferation. McLean, VA: MITRE Corporation, January 1998.

Kroutil, Dr. Robert T. Program SAFEGUARD: Brief Overview Summary of the Concept of Operations. Edgewood Research, Development, and Engineering Center, Aberdeen Proving Grounds, MD, June 1996.

Senate Committee on Governmental Affairs. Proliferation Primer: A Majority Report of the Subcommittee on International Security, Proliferation, and Federal Services. Washington, DC: Government Printing Office, January 1998.

US Army Chemical and Biological Defense Command. Domestic Preparedness Defense Against Weapons of Mass Destruction (WMD). Aberdeen Proving Ground, MD: Department of the Army, 1998.

U.S. Army Chemical School. Summary Evaluation Report for Combined Arms in a Nuclear/Chemical Envirnment Force Development Test and Experimentation -Close Combat Light. Washington, DC: Department of the Army, May 1993.

US Army Chemical School. Theater Missile Defense (TMD) Passive Defense Strategy. Washington, DC: Department of the Army, May 1997.

U.S. Congress. Global Proliferation of Weapons of Mass Destruction: A Case Study of Aum Shinrikyo. Congressional Testimony Hearing 31 October 1995. Washington DC: U.S. Government Printing Office, 1996.

INITIAL DISTRIBUTION LIST

Combined Arms Research Library
U.S. Army Command and General Staff College
250 Gibbon Avenue
Fort Leavenworth, Kansas 66027-2314

Defense Technical Information Center
8725 John J. Kingman Road, Suite 944
Fort Belvoir, Virginia 22060-6218

LTC Deborah Gregoire
1325 Revolutionary Court
Leavenworth, Kansas 66048

MAJ Bruce A. Leeson, Ph.D.
USDB-DMH
U.S. Disciplinary Barracks
Fort Leavenworth, Kansas 66027

DARPA Library
3701 North Fairfax Drive
Arlington, Virginia 22209-2308

Chairman
Counterproliferation Program Review Committee
Mr. Walter L. Busbee
Office of the Counter Proliferation and Chemical
and Biological Defense
The Pentagon 3C125
Washington, DC 20301-3050

GEN Richard B. Myers
Commander
United States Space Command
250 South Peterson Blvd
Peterson AFB, CO 80914-3190

LTG John Costello
Commander
United States Army Space Command
Arlington, Virginia 22209

MG Ralph G. Wooten
Commandant
United States Army Chemical School
ATTN: ATZN-CM-Z
Fort McClellan, Alabama 36205

Dr. Robert Kroutil
U.S. Army Edgewood Research Development
and Engineering Center
Research and Technology Directorate
ATTN: SCBRD RT/E5951
Aberdeen Proving Ground, Maryland 21010-5423

BG Wayne M. Hall
2511 Jefferson Davis Highway
Suite 9300
Arlington, Virginia 22202

COL Pat Nilo
Chief, Chemical NBC Defense Division
Office of the Deputy Chief of Staff
for Operations & Plans
ATTN; DAMO-FDB
The Pentagon
Washington, D.C. 20310

COL Stephen Reeves
AMCPM-NM
Project Officer, NBC Defense Systems
Aberdeen Proving Grounds, Maryland 21010-5401

COL(R) Carmen J. Spencer
Director, Chemical-Biological Defense Directorate
Defense Threat Reduction Agency
45045 Aviation Drive
Dulles, Virginia 20166-7517

COL Dan Uyesugi
Assistant Commandant
United States Army Chemical School
ATTN: ATZN-CM-A
Fort McClellan, Alabama 36205

COL Lenny Izzo
Director of Combat Developments
United States Army Chemical School
Fort McClellan, Alabama 36205

COL Steve Chapman
Director of Training
United States Army Chemical School
Fort McClellan, Alabama 36205

Dr. Burton Wright
Command Historian
United States Army Chemical School
Fort McClellan, Alabama 36205

MAJ Robert Kubler
Chief of Doctrine
United States Army Chemical School
Fort McClellan, Alabama 36205

COL Darryl Kilgore
III Corps Chemical Officer
Fort Hood, Texas 76544

COL Mike Brown
United States Army Element, The Joint Staff J5
The Pentagon
Washington, D.C. 20318-5000

CERTIFICATION FOR MMAS DISTRIBUTION STATEMENT

1. Certification Date: 4 June 1999

2. Thesis Author: MAJ William E. King, IV

3. Thesis Title: Achieving Nuclear, Biological, and Chemical Defense Synergy Through Integrated Land, Air, and Space-Based Sensors and Analysis.

4. Thesis Committee Members Signatures:

5. Distribution Statement: See distribution statements A-X on reverse, then circle appropriate distribution statement letter code below:

(A) B C D E F X SEE EXPLANATION OF CODES ON REVERSE

If your thesis does not fit into any of the above categories or is classified, you must coordinate with the classified, you must coordinate with the classified section at CARL.

6. Justification: Justification is required for any distribution other than described in Distribution Statement A. All or part of a thesis may justify distribution limitation. See limitation justification statements 1-10 on reverse, then list, below, the statement(s) that applies (apply) to your thesis and corresponding chapters/sections and pages. Follow sample format shown below:

----------SAMPLE----------SAMPLE----------SAMPLE----------SAMPLE----------

	Limitation Justification Statement	/ Chapter/Section	/ Page(s)	
SAMPLE	Direct Military Support (10)	/ Chapter 3	/ 12	SAMPLE
	Critical Technology (3)	/ Section 4	/ 31	
	Administrative Operational Use (7)	/ Chapter 2	/ 13-32	

----------SAMPLE----------SAMPLE----------SAMPLE----------SAMPLE----------

Fill in limitation justification for your thesis below:

Limitation Justification Statement	/ Chapter/Section	/ Page(s)
	/	/
	/	/
	/	/
	/	/

7. MMAS Thesis Author's Signature:

STATEMENT A: Approved for public release; distribution is unlimited. (Documents with this statement may be made available or sold to the general public and foreign nationals).

STATEMENT B: Distribution authorized to U.S. Government agencies only (insert reason and date ON REVERSE OF THIS FORM). Currently used reasons for imposing this statement include the following:

1. Foreign Government Information. Protection of foreign information.

2. Proprietary Information. Protection of proprietary information not owned by the U.S. Government.

3. Critical Technology. Protection and control of critical technology including technical data with potential military application.

4. Test and Evaluation. Protection of test and evaluation of commercial production or military hardware.

5. Contractor Performance Evaluation. Protection of information involving contractor performance evaluation.

6. Premature Dissemination. Protection of information involving systems or hardware from premature dissemination.

7. Administrative/Operational Use. Protection of information restricted to official use or for administrative or operational purposes.

8. Software Documentation. Protection of software documentation - release only in accordance with the provisions of DoD Instruction 7930.2.

9. Specific Authority. Protection of information required by a specific authority.

10. Direct Military Support. To protect export-controlled technical data of such military significance that release for purposes other than direct support of DoD-approved activities may jeopardize a U.S. military advantage.

STATEMENT C: Distribution authorized to U.S. Government agencies and their contractors: (REASON AND DATE). Currently most used reasons are 1, 3, 7, 8, and 9 above.

STATEMENT D: Distribution authorized to DoD and U.S. DoD contractors only; (REASON AND DATE). Currently most reasons are 1, 3, 7, 8, and 9 above.

STATEMENT E: Distribution authorized to DoD only; (REASON AND DATE). Currently most used reasons are 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10.

STATEMENT F: Further dissemination only as directed by (controlling DoD office and date), or higher DoD authority. Used when the DoD originator determines that information is subject to special dissemination limitation specified by paragraph 4-505, DoD 5200.1-R.

STATEMENT X: Distribution authorized to U.S. Government agencies and private individuals of enterprises eligible to obtain export-controlled technical data in accordance with DoD Directive 5230.25; (date). Controlling DoD office is (insert).